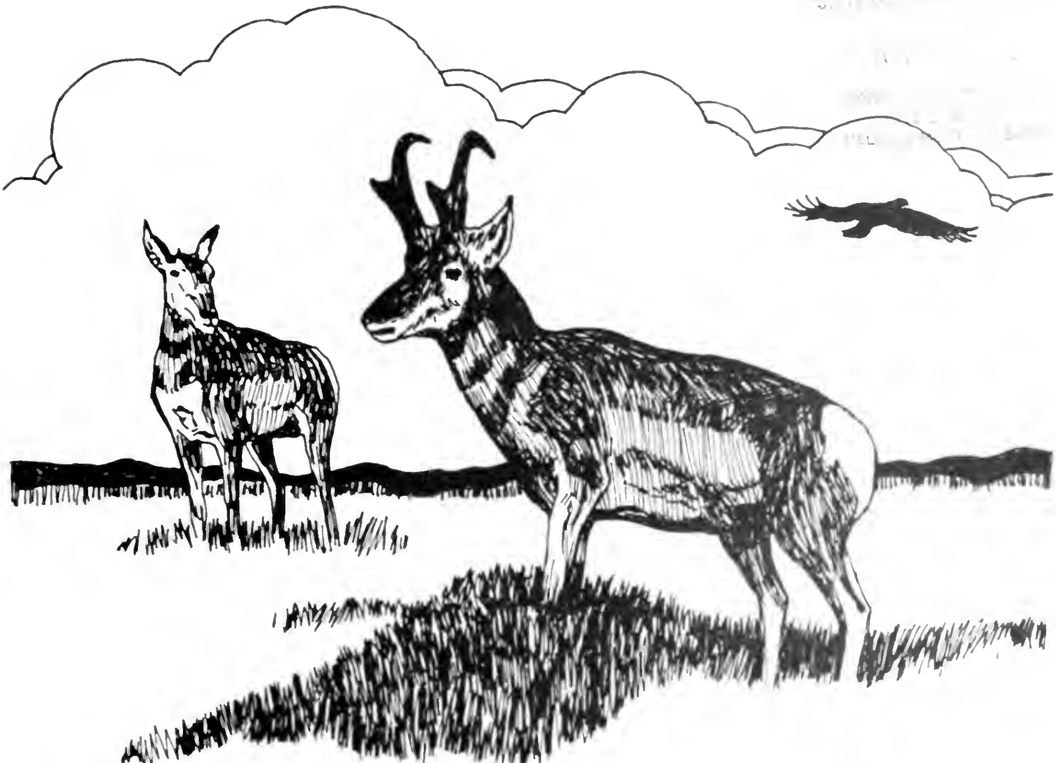
THE NET ECONOMIC VALUE OF ANTELOPE HUNTING IN MONTANA



Montana Department of Fish, Wildlife & Parks

THE NET ECONOMIC VALUE OF ANTELOPE HUNTING IN MONTANA

Dr. John Loomis
Division of Environmental Studies
Department of Agricultural Economics
and
Joseph Cooper, Graduate Research Assistant[1]
Department of Agricultural Economics

University of California, Davis
Davis, CA 95616

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EXECUTIVE SUMMARY

The net willingness to pay of antelope hunters in Montana was estimated using a multi-site regional Travel Cost Method (TCM). Data for the Travel Cost Method came from 1985 survey of Montana antelope hunters. In a departure from the usual TCM, which estimates the average value per trip, the average value per antelope hunting permit is estimated instead. The TCM demand curve indicates that antelope hunting applications are positively related to success rate and income and negatively related to travel distance. For Montana antelope hunting, the state's average value was $143 per permit. This means a hunter would be willing to pay, on average, $143 more per permit so as to have the opportunity to hunt the specific antelope unit they applied for. The net willingness to pay per hunter day is $62. The value per U.S.F.S. 12 hour Recreation Visitor Day is $135. The Net economic value of antelope hunting under the existing lottery is $6 million dollars annually. Net economic values for per permit for hunting antelope in Region 3 is $133 per permit, $112 per permit in Region 4, $139 per permit in Region 5, $162 per permit in Region 6 and $170.30 in Region 7.

Expenditures of Montana antelope hunters average $114 per trip. This represents spending of $49.63 per hunter day or $108 per 12 hour Recreation Visitor Day. Transportation represented the major cost item for residents, but hunting fees represented the largest components for nonresidents.

PURPOSE AND SCOPE OF RESEARCH

The objective of this research is to statistically estimate, using a survey of Montana hunters, the net economic value (net willingness to pay) for antelope hunting in Montana . The hunting benefit estimates by substate region and for the entire state are derived from a regional (multi-site) TCM demand equation. These estimates should prove useful in U.S. Forest Service and Bureau of Land Management multiple-use planning decisions. These values also are suitable for evaluation of the benefits of habitat improvements (as performed by BLM using SAGERAM) or making trade-offs between wildlife and livestock.

DEFINITION OF BENEFITS

Many Federal agencies are required by U.S. Water Resources Council Principles and Guidelines (1983) to use the concept of net willingness to pay (e.g., net economic value) as a measure of value in Benefit Cost Analysis or evaluation of Federal actions. When performing natural resource damage assessments, the U.S. Department of Interior regulations require that the calculation of economic values lost to society be measured in terms of net willingness to pay (U.S Department of Interior, 1986). Use of the net willingness to pay criteria is also recommended in textbooks on Benefit Cost Analysis (Sassone and Schaffer, 1978; Just, Hueth and Schmitz (1982).

SPECIFICS OF RECREATION DEMAND AND BENEFIT ESTIMATING METHODOLOGY

The method employed in this study is a variation on the regional Travel Cost Method (TCM). The regional TCM approach is recommended by the U.S. Water Resources Council (1979, 1983) as one of the two preferred techniques for estimating recreation benefits. The method is one of the most widely applied demand estimating techniques. To statistically trace out a demand equation, TCM uses observations of travel distance as a measure of price and trips taken as a measure of quantity. The resulting first stage, or per capita demand equation allows the analyst to calculate the additional amount antelope hunters would pay over and above their travel costs to have access to the site for hunting. This calculation is made using a "second stage", or site demand curve that relates added distance or added travel cost to trips at a particular hunting district. See Clawson and Knetsch (1966), Dwyer, Kelly and Bowes (1977), Sorg and Loomis (1985) or Ward and Loomis (1986) for a discussion of the basic TCM approach.

Estimating First Stage or Per Capita Demand Equation When Permits are Rationed by a Lottery

The traditional Travel Cost Method (TCM) demand equation has as its dependent variable, trips per capita from a given zone (e.g., county) of origin to a particular site. However, one of the assumptions of TCM is that all recreators at any given distance are able to visit as frequently as they desire. That is, observed visitation rates are supposed to reflect the desired level of consumption given the travel cost facing the hunter

(Dwyer, Kelly and Bowes, 1977). However, in the case of antelope hunting in Montana, there is excess demand for permits. As a result not all hunters desiring to go antelope hunting at the current permit and travel price are allowed to hunt antelope. The excess demand is rationed by the Montana Department of Fish, Wildlife and Parks by means of a lottery. As an approach to account for the real, underlying demand, rather than just that portion of demand actually realized as an outcome of the lottery, applications per capita is used rather than trips per capita as the dependent variable. Applications reflect the consumption that antelope hunters desire at current permit and travel prices. Thus, use of applications meets the assumptions of the Travel Cost Method whereas trips, in this case, would not. For more details see Loomis, 1982.

The basic per capita or first stage TCM demand equation estimated for antelope hunting is given in equation 1 as:

(1) (APPLICij/POPi)=Bo-B1(DISTij)+B2(SUCCESSj)+B3(DEMOGi)+B4(SUBSik)

where:

APPLIC/POP=hunting applications per capita from county i to hunt district j.

DIST = one way trip distance from the hunter's county of residence i to the hunt district j.

SUCCESS = hunter success in percent at hunt district j.

DEMOG = Demographics such as income, age, years hunted, etc. of hunters in county i.

SUBS = an index reflecting the quality and location of substitute hunting

areas k available to county i.

Assumptions of the Travel Cost Method

The critical assumptions in terms of the estimation of economic values are:

1. Interpretation of travel distance as price paid to visit the site. The reasonableness of this assumption depends on two factors:

   a. Issue of Multi-destination trips

   b. Issue of Value of Travel Time

In the first case, for travel distance and travel cost to be considered the price paid to visit the site, such travel costs must be incurred exclusively to gain access to the recreation site. If the trip has many destinations, we cannot correctly interpret all of the travel cost as a price paid for hunting at any one particular hunting district. To satisfy this assumption we asked the hunter if this site was their primary destination. That is, would they have made the trip if hunting access to this site was not available. If the hunter said he or she would still make the trip regardless of the availability of this site since the trip's primary purpose was to visit another site, or to engage in some nonhunting activity (e.g, business), then this hunter would be excluded from the sample as it does not meet the single trip destination criteria needed to interpret travel cost as price of access to the site.

The issue of converting travel distances to a monetary price involves accounting for two costs of travel: transportation cost and opportunity

cost of travel time. To convert distance to 1984 dollars, we used two measures of vehicle costs. One is the variable costs of vehicle operation from the U.S. Department of Transportation's "Cost of Owning and Operating a Vehicle-1984". Not only is this publication a widely used source for operating costs, but it is recommended by the U.S. Water Resources Council (1979, 1983) for use in performing Travel Cost Method studies. However, the cost per mile obtained from this report does not reflect the higher vehicle operating costs associated with driving vehicles often used for recreation, driving conditions on recreational roads, etc.. To account for this we also calculated benefits using data on reported trip expenditures in our sample. This approach will be discussed more in detail later.

Since time is scarce, time spent traveling has an opportunity cost in terms of either foregone time hunting at the recreation site or foregone time spent in other activities which may also be recreational, such as leisure, i.e. sleeping, watching TV, reading, etc., or nonrecreational, such as time spent working. Long travel times act as a deterrent to visiting more distant sites, even to hunters with sufficiently high incomes such that transportation cost is not a factor. There is empirical evidence that travel time is viewed as costly both in the transportation planning (Cesario, 1976) and in sportfishing (McConnell and Strand, 1981) literature. In the case of Rhode Island saltwater sport anglers, comparison of the deterrent effect of travel time and travel cost, indicated that anglers valued the time spent travelling at about 60% of

their wage rate. The value of time saved is recognized in highway benefit cost studies as well. The U.S. Water Resources Council (1979, 1983) relies on Cesario's (1976) work and suggests using a value between one-fourth and one-half the wage rate as a proxy for the opportunity cost of time. It should be noted that the wage rate is used as a proxy for opportunity cost of time in all other activities and it is used even if the hunter would not have been working. In this study we used one-third of the state wage rate for the value of travel time --per the U.S. Water Resources Council (1979, 1983)--for the standard cost approach. For the reported cost approach, we statistically derived the percentage of the wage rate to be used for the value of time as revealed from travel behavior of sampled antelope hunters. These two cost approaches will be discussed later. An approximation of the antelope hunter's wage rate was calculated based on 2,691 total work hours per household, of which 2000 hours are attributed to the primary wage earner of the household and the balance to the secondary wage earner(s).

2. Statistical requirements that insure an ordinary least squares regression yield the best linear unbiased estimates of the coefficients.
In any statistical estimation that relies on ordinary least squares regression, certain assumptions must be met for the regression (slope) coefficients to have the desired properties of best linear unbiased estimates. While most of the assumptions are met when using cross-section data, such as is required in TCM, the assumption of omitted variables is of particular concern. In particular, if the omitted variable is strongly

correlated with the price variable, our estimates of net benefits may be over or underestimated. Two explanatory variables that one often wishes to include when performing TCM analyses are income and price-quality of substitutes. In cases were these variables were significant, they are included in the demand equations. When such variables were not significant --at least in the particular forms tried, they were not included in the final demand equations.

Calculation of Benefits from the Per Capita Demand Equation: The Second Stage Demand Curve

Once the per capita demand equation of the form in equation 1 is estimated using ordinary least squares regression, benefits can be calculated in several ways. First, the per capita curve could be integrated for each zone of origin between the current distance and the maximum distance that would drive visits to less than one to calculate net willingness to pay for each zone. Site benefits would be the population's weighted sum of each zone's net willingness to pay. Alternatively, a "second stage" or site demand curve can be estimated from equation 1. This site demand curve relates total site visitation to increases in distance (or travel costs) over and above the existing distance (or cost). The area under this site demand curve is net willingness to pay. This second stage demand curve approach is used in this program since it is more amenable to programming with LOTUS 123. The equivalence of these two approaches has been demonstrated in the literature (Burt and Brewer, 1971; Menz and Wilton, 1983).

Since the antelope second stage demand curve related added dollars to total applications rather than trips, one additional step is necessary to arrive at the net economic value of a permit. The area under the second stage TCM demand curve is calculated as above, but it is then divided by the estimated number of applications to arrive at an average value per

application. While this is an average, Mumy and Hanke (1975) demonstrated that when an equal chance rationing system is in place, such as a lottery, that the average equals the marginal value. In essence, the lottery gives high and low valued users equal chances of receiving a permit. The result is that the "demand curve" is horizontal at the statistical expected value of the permit. Since the expected value equals the average value of the permit, the average value is the value of providing or taking away an additional permit. The demand curve is horizontal at this average value because of the absence of pricing. Pricing ranks hunters with high to low valued demands and assures that high valued users receive a permit before low valued demands are satisfied.

DATA SOURCES

The main source of information on hunters' origins and site destinations was obtained from a telephone survey of licensed hunters performed by Montana Department of Fish, Wildlife and Parks. This survey was performed in January and February 1986. The survey involved mailing a short one page questionnaire and hunting map to hunters to be sampled. The hunter was told to answer as many of the hunting related trip questions as possible. The hunter was also told to expect a phone call from Montana Fish, Wildlife and Parks. This phone interview would require the hunter to read back their answers to the questions already asked, and then answer a few additional questions. The response rate on this survey was 95.7%.

The two page survey was a brief diary of sorts, in which the hunter was asked to list the sites visited, species hunted, travel distance, etc. for each big game hunting trip during that Fall season. This survey also asked information about trip expenditures, vehicle driven for hunting, and hunter demographics such as income, education, age, years hunted, etc. , Trip expenditures included transportation costs, food, lodging and guide fees. The breakdown of total expenditures is provided in the Results Section. A map showing the specific hunt regions surveyed is also provided in the Results Section. This survey instrument is provided in the Appendix.

STATISTICAL ESTIMATION OF ANTELOPE HUNTING DEMAND EQUATION

The basic variables shown in equation 1, i.e. distance, income, etc., were obtained from the survey discussed above.

The substitute variable had to be constructed using both the distance variable and the site's total Antelope harvest. The substitute index measures the availability of substitute hunting sites for each county of origin. If an alternative site is regarded as more attractive than the actual site visited, then it is a potential substitute for that site. For simplicity, the attractiveness of a site is defined as that site's total harvest divided by the hunter's round trip distance to that site. For each observation, if any other site's attractiveness index is greater than or equal to that of the site actually visited, then that alternate site is a substitute for the site actually visited. For each observation, the attractiveness indices of all of the substitute sites are summed together. This summation is the substitute index. The estimated coefficient for this variable should have a negative sign as the greater the availability (more sites that are closer) and attractiveness (greater the harvest) of substitute hunting units to the actual site visited in any particular observation, the lower the hunter's willingness to pay for the site actually visited would be.

ANTELOPE HUNTING TCM DEMAND EQUATION

The results of the estimation of equation 1 is as follows:

$$(2)\ln(APPLICATONSij/POPi) = -13.160 -0.964[\ln(ONEWYDISTij)]$$

(t-statistics) (-7.376)

$$+1.436[\ln(SUCCESSj)]+0.455[\ln(AVINCOMEi)]-0.116[\ln(SUBSINDEXik)]$$

(2.979) (2.768) (-1.920)

ONEWAYDIST=One way trip distance from county i to hunt unit j.

SUCCESS=hunting success rate in the previous year in hunt unit j.

AVINCOME=average hunter income in county i

SUBSINDEX=the substitution index for county i to substitute hunt unit k

R-squared = 0.376, Observations = 108, F-Statistic = 15.15

The R-squared is typical for cross section data and similar to many other TCM demand equations. In addition, all the coefficients are of the expected sign and all but SUBSINDEX are significant at the 99% level (SUBSINDEX is significant at the 90% level).

One-way distance was used for price instead of the more correct round trip distance. This will be adjusted for in the benefit calculations, where the per mile figure used to convert miles to dollars will be doubled to reflect the fact that one-way rather than round trip miles were used in estimation of the demand equation. Round trip distance is the more correct figure as

the price of the trip includes driving to the site and returning home.

The equation was estimated in the double-log form for a number of reasons. The most important reason for choosing a log model is that past research has shown that taking the natural log of the applications per capita minimizes two problems that arise with a linear model. First, with the log of applications per capita, the possibility of predicting negative applications per capita from distant counties is eliminated. Second, heteroskedasticity associated with zones of different population sizes is minimized using the log of the dependent variable (Strong, 1983).

The estimated demand equation indicates that applications per capita to a particular hunt unit is quite sensitive to the previous years success rate in that unit.

BENEFIT CALCULATIONS

From the per capita demand equation 2, we calculated each site's second stage demand curve. Because the price variable in the per capita demand equations is in terms of miles instead of a monetary denomination, the area under the second stage demand curve represents willingness to pay in additional miles. In order to calculate net economic values in dollars, the hunter's additional willingness to pay in miles must be converted to willingness to pay in dollars. This involves multiplying the added distance by a cost per mile of distance. This travel cost per mile is the sum of two components, vehicle operating cost per mile and value of travel time.

There are at least two approaches to converting the added willingness to pay in miles into dollars. The specifics of these two approaches are explained in detail below. The first approach follows the U.S. Water Resource Council procedures (1979, 1983) of using one-third the wage rate as the cost of travel time and variable automobile costs from the U.S. Department of Transportation. This approach is the standard cost method. The other approach, the reported cost method, is to empirically estimate from our data set what fraction of the wage rate that should be used for valuing travel time of antelope hunters and determining the variable costs of operating the types of vehicles used in antelope hunting. Both approaches are discussed in more detail below. By using both approaches we can make our results comparable to others who have used the U.S. Water Resource Council approach and also bracket the likely true values of

antelope hunting. Both the standard and reported cost estimates of net willingness to pay are presented in Table 1.

Standard vehicle transportation costs per mile represent the variable costs of operating a standard size vehicle. This figure was obtained from the U.S. Department of Transportation's Cost of Owning and Operating Vehicles and Vans-1984 and is $.152 per mile. This approach is recommended by the U.S. Water Resources Council (1979, 1983). To take into account the likelihood that each passenger in a vehicle pays his share of the operating cost, the operating cost per mile figure is divided by the average number of passengers per vehicle, which was 2.44 for the data set.

In addition to the standard cost per mile figure used in the model, a trip cost per mile based on the actual survey responses was estimated. In order to estimate the model's reported cost per mile, a regression with trip cost as the dependent variable and one-way distance as the regressor was performed on the subset of the data that refleted individual observations. To minimize the burden on the respondent, data on individual trip expenditures were collected for only one-randomly selected trip. Since trip expenditure data was collected only for this one trip, this data set was a subset of the larger one used to estimate the overall demand equation.

Trip cost was calculated as the sum of the costs spent on the vehicle itself plus various incidental costs. The vehicle components of trip cost

are the total transportation costs, which include outlays for gas, oil, and wear and tear. The incidental costs, or the costs aside from the actual transportation costs incurred during the trip, include the cost of lodging, food and beverages bought in stores, food and beverages bought in restaurants, fees paid to guides or outfitters, and other miscellaneous on site purchases.

The regression results are as follows:

TRIPCOSTij = 83.681 + 0.2644 ONEWAYDISTij

(t-statistic): (9.897)

R-squared = 0.296 n = 235 F-statistic = 97.95 .

Since 0.2644 corresponds to the slope of the function, which is TRIPCOSTij/ONEWAYDISTij, then $ 0.2644 must be the trip cost per round trip mile. Because $0.2644 is the derivative of the TRIPCOST function with respect to distance, it can also be considered as the <u>variable cost per mile.</u> But because TRIPCOST is the round trip cost while the distance used is one way, variable cost is doubled over its actual one way value. Therefore, the actual variable cost per mile travelled is halved or $ 0.1322 per mile. Since the operating cost figure used for the reported cost estimation is a per hunter figure, it can be used as is.

In both approaches the opportunity cost of travel time reflects the deterrent effect that longer drives have on visiting more distant sites, independent of the vehicle operation costs. For example, many higher income people could afford the extra $8.00 of gasoline incurred if they

drove an additional two hours, but many could not "afford" the additional time cost in terms of other activities foregone. The hourly wage is used as a proxy for the opportunity cost of time. This is in part due to work by Cesario (1976), which showed the opportunity cost of time in commuting studies equaled between one-fourth and one-half the wage rate. In this study, the U.S. Water Resources Council Principles and Guidelines (1983) were followed, with the opportunity cost of time calculated as one-third of average wage rate. The average wage rate was calculated as yearly household hunter income divided by 2691 hours, the typical number of hours worked per year per household. Next, this new dollar per hour figure was divide by 39 miles per hour, the average speed driven by antelope hunter in the data set. The resulting figure is the opportunity cost per mile.

The hunters "reported" opportunity cost of time was determined along the lines of a model as specified by McConnell and Strand (1981). The equation is:

TRIPSij/POPi = Bo + B1*Cij + B2*(Aij*Vi) + B3*SUBSik + B4*INCOMEi

where:

Cij = the round trip expenses per person i hunting in hunt area j

Aij = the round trip travel time from county i to hunt area j,

Vi=the average hourly income per hunter (annual family income/2691)

SUBSik = a substution index previously discussed above.

INCOMEi= annual family income of hunter

Because the model is being used solely to estimate the trade-off between

the transportation cost and travel time, and because we have the observed travel time as well as the dollars spent on primary travel mode for all trips taken, C is defined as travel costs for primary mode of travel. To be consistent, since the TCM demand equation was estimated with the aggregated zonal data, this equation was also estimated with the aggregated zonal data.

From McConnell and Strand (1981) the expected signs and relationships are $B1<B2<0$. $B1<B2$ implies that the opportunity cost of travel time is less than average income. The site variables, SUBS and INCOME, attempt to capture variations due to different characteristics of the sites or hunter. Fitting the equation to our data yields:

TRIPS/POP=0.0001309-.000005788*C-.000002885*AV+.0000009292*INCOME

(t-statistic): (-1.790) (-1.848) (1.072)

+.000003707*SUBS

(0.194)

where n = 151, R-squared = 0.101, F = 4.129. Note that the C variable (travel cost) and the AV (value of travel time) are significant at the 90% level, that B1 and B2 are of the expected sign, and that $B1<B2$. SUBS and INCOME did not test significant at the 90% level.

The opportunity cost of time, measured as a percentage of the wage rate, is B2/B1 (McConnell and Strand, 1981), which is 49.8% for this data set.

Now that the opportunity cost of time has been estimated, the reported cost per mile per hunter of Montana Antelope can be calculated. The reported cost per hunter is:

(round trip cost per mile per hunter)

+49.8%*[(avg. household income/ 2691 household work hrs)/avg.mph]

which equals $0.1322 + .498*[(27,699/2691)/39.22] = $0.26 per mile.

Since this is a trip cost per mile driven it must be doubled to account for the fact the distance variable was one way distance in estimated per capita demand equation. Doubling this figure yields the one way trip cost, which is $0.52 per mile.

RESULTS

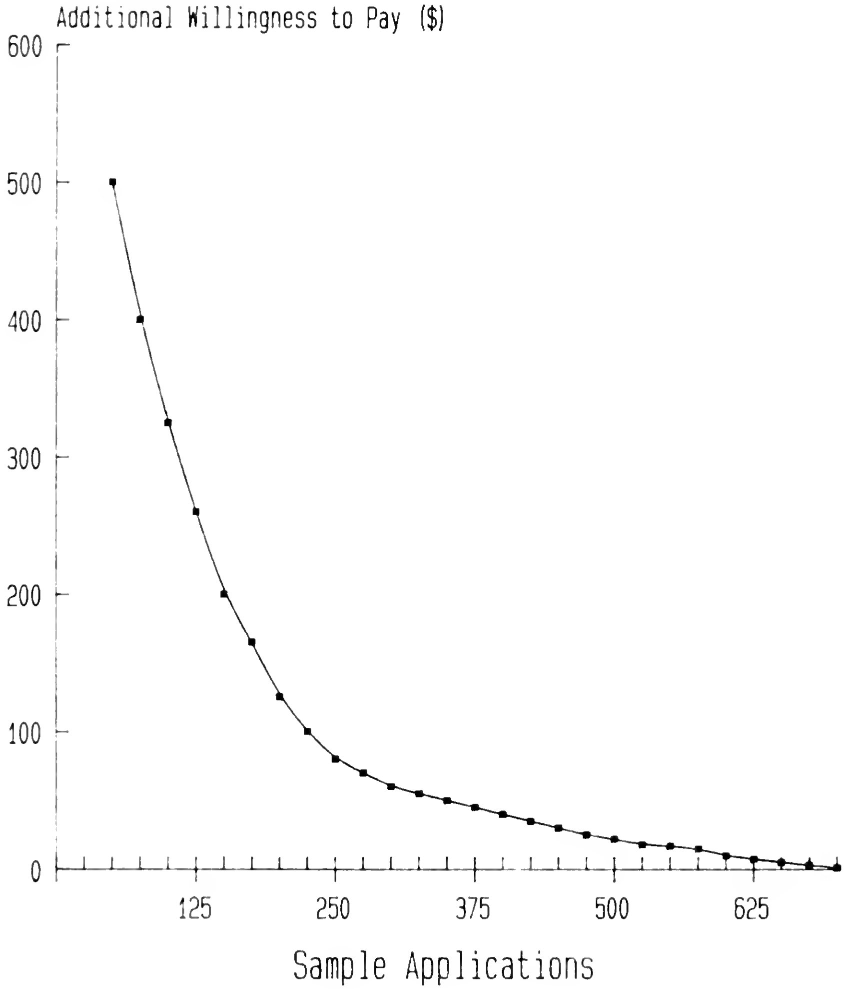
Net Economic Value

As stated earlier in this report, the area under the second stage demand curve represent's the hunters net willingness to pay to have access to this hunting site, over and above the expenditures required to get to the site. To arrive at this figure, total actual applications per site must be estimated at existing travel costs. Then additional distance is added to the existing distance (in demand equation (2)) and site applications are re-estimated at this added distance. The process of adding miles to current distance is repeated to derive the site's demand schedule which shows site visitation at alternatively higher and higher fees. Such a second stage demand schedule is shown in Figure 1 for hunt district #701

With the double log model, trips would never fall to exactly to zero. To be conservative, we truncated the top of the second stage demand curve at the maximum observed trip distance, which was 1800 miles one way. The area under this curve starting at the base value and ending where distance is 1800 miles is the net willingness to pay, or the amount the sampled antelope hunters are willing to pay above the actual amount paid.

Estimated total applications for the entire sample data set were 7,173. The actual total applications for the sample was 12,298. The prediction is conservative by a substantial degree. However, with an adjusted R-squared of 35%, this disparity is not unusual. Note this underestimation of antelope hunting applications implies that, since we are underestimating

FIGURE 1
Second Stage Demand Curve



Site 701 - Montana Antelope

demand, our benefit estimates may be on the conservative side.

While the demand equation was estimated treating hunt districts as destinations to enhance specificity of the statistical estimation, some of the hunt districts in the study had relatively small sample sizes. To account for this, the benefit estimates of hunt districts within Montana Department of Fish, Wildlife and Parks Regions were combined for reporting purposes. Therefore, benefits per hunter day are shown in Tables 1 and 2 by region instead of a per hunt district. A map showing the location of each region in Montana is provided in Figure 2.

The net willingness to pay per permit averaged over the five regions is reported in Table 1 as $143 using the reported cost to miles conversion. With a typical antelope hunter afield for 2.31 days, this translates to $62 per hunter day. This means an antelope hunter would pay an additional $62 per day to hunt antelope at his current hunt district rather than some alternative hunt district. For some of the hunters this "premium" may be due to locational advantage (e.g., relative closeness) of this hunt district to his residence, the success rate, scenery or some other characteristics that makes other antelope hunting districts less than perfect substitutes. The average antelope hunter spends 5.5 hours hunting per day. Therefore, a U.S. Forest Service 12 hour Recreation Visitor Day (RVD) or Wildlife Fish User Day (WFUD) would be $135. The specific values for each Region are reported in Table 2. The value per permit calculated at the standard cost figure presented in Table 1 is comparable to the value

Figure 2. Antelope hunting areas.

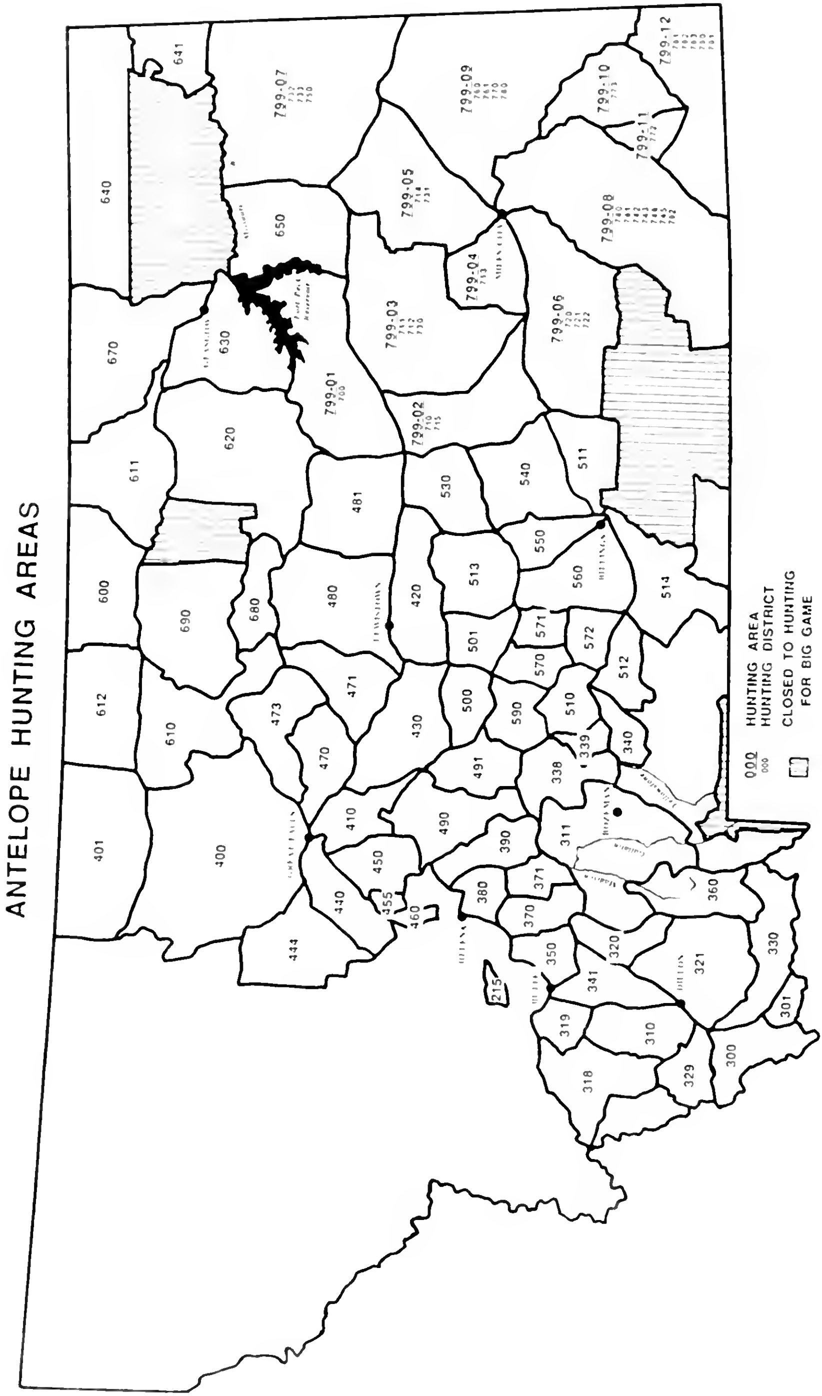


TABLE 1
MONTANA ANTELOPE HUNTING
NET ECONOMIC VALUES
(1985 Dollars)

REGION	STANDARD COST NET WILLINGNESS TO PAY PER APPLICATION	REPORTED COST NET WILLINGNESS TO PAY PER APPLICATION
300	$76.76	$133.06
400	64.48	111.77
500	80.31	139.20
600	93.50	162.10
700	98.27	170.30

STATE AVERAGE VALUE PER APPLICATION-STANDARD COST: $82.66
STATE AVERAGE VALUE PER APPLICATION-REPORTED COST: $143.30

TABLE 2
NET ECONOMIC VALUES PER DAY
FOR MONTANA ANTELOPE HUNTING
(AT REPORTED COST CONVERSION)

REGION	DAYS/TRIP	NET ECONOMIC VALUE PER HUNTER DAY	HOURS/DAY	NET ECONOMIC VALUE RVD OR WFUD
300	1.59	$83.69	4.36	$230.74
400	1.70	$65.75	5.43	$145.31
500	1.50	$92.80	5.71	$194.91
600	3.33	$48.68	6.46	$90.43
700	2.90	$58.62	5.29	$132.90

TABLE 3
NET ECONOMIC VALUE PER SITE
FOR MONTANA ANTELOPE HUNTING

REGION	NET WILLINGNESS TO PAY PER HUNTER DAY	NUMBER OF HUNT DAYS	TOTAL SITE VALUE
300	$83.69	8667	$725,303
400	$65.75	9823	$645,833
500	$92.80	16469	$1,528,323
600	$48.68	19551	$951,717
700	$58.62	37575	$2,202,672
		STATE TOTAL:	$6,053,848

estimated in 1982 for antelope hunting in Idaho (Loomis, et al., 1985). Table 3 reports total value of antelope hunting in Montana as $6 million dollars annually using the Travel Cost Method of valuation.

Expenditures

Table 4 provides a breakdown of antelope hunter expenditures by resident and non-resident classification. As one might expect non-resident's average transportation, lodging and food bought in restaurants is three to five times greater than resident's. Overall, non-resident antelope hunters spend, on a per hunter basis, approximately eight times what residents do. The weighted (by mix of residents and non-resident's) average expenditure by antelope hunters is $49.63 per hunter day. This results in $4.3 million in expenditures by Antelope hunters in Montana.

TABLE 4
PER TRIP RESIDENT AND NON RESIDENT ANTELOPE HUNTER EXPENDITURES

CATEGORY	AVERAGE RESIDENT EXPENDITURE	AVERAGE NON RESIDENT EXPENDITURE
Transportation	$31.81	$153.87
Lodging	$4.42	$28.16
Food bought in Stores	$12.02	$53.39
Food bought in Restaurants	$5.96	$35.71
Fees	$0.00	$154.84
Miscellaneous	$4.03	$8.45
TOTAL PER TRIP	$58.24	$434.42

OVERALL AVERAGE PER TRIP	$114.66
OVERALL AVERAGE PER DAY	$49.63
OVERALL AVERAGE PER RVD	$108.19

CONCLUSION

The Travel Cost Method was successfully applied to estimating the net economic value of a day of antelope hunting in Montana. The value of antelope hunting is positively related to the expected success rate. Given the lottery rationing of antelope permits, the average willingness to pay of $143 per permit or $62 per hunter day equals the marginal willingness to pay. Therefore the values presented in this report can be used for Benefit Cost Analysis or other economic efficiency analyses such as U.S. Forest Service's FORPLAN or Bureau of Land Management's SAGERAM model. The net willingness to pay amounts are commensurate with commodity values. When these annual values of wildlife are put into present value terms (e.g., capitalized) they can be used in trade-off analyses with marketed resources such as coal, livestock grazing or land development.

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INTERVIEW DATE ________

INTERVIEWER ________

Did not hunt this past season ________

HUNTING SURVEY

For random trip# (1 die)
if >6, roll again and add to 1st as needed

Question		HUNTING TRIP 1st	2nd	3rd	4th	5th	6th	7th	8th
1. Primary hunting area? (From Map)									
2. Was the primary purpose of your trip to hunt big game?	YES								
	NO								
3. Primary species you selected the area for?	ELK								
	DEER								
	ANTELOPE								
4. Number of game you killed?	ELK								
	DEER								
	ANTELOPE								
5. Type of weapon used?	FIREARM								
	ARCHERY								
6. Total number of days away from home	DAYS								
7. Total number of hours hunted.	(HOURS)								
8. One way distance to hunting area	(MILES)								
9. Was this area the primary place you hunted? (If yes go to next question)	YES								
If no, how may areas did you hunt in? (Terminate and start next hunting trip)	NO								
10. How many years have you visited this area to hunt big game?	YEARS								
11. If you were unable to hunt in this area (due to emergency closure) would you have hunted this species at another area? If yes which one?	YES AREA								
	NO								
12. About how long did it take to travel from your home to ______? (This should start when they left home and end when they arrived at the hunting area)	DAYS								
	HRS.								
	MIN								
13. Did you travel entirely by vehicle? YES ____ (If yes, fill in only 1st Mode section)	1st MODE TYPE								
	MILES								
	$SPENT								
NO ____ (If no, fill in as many Modes as necessary)	2nd MODE TYPE								
	MILES								
	$SPENT								
Would you estimate the miles you traveled and what your transportation costs were?	3rd MODE TYPE								
	MILES								
	$SPENT								
14. If you had not gone hunting, would you have been working?	YES								
	NO								
15. If yes, did this trip result in lost income?	YES								
	NO								
16. If yes, could you estimate about how much you lost by going hunting? (Ask only once)									

MODE TYPE

1. Compact (4 cyl)
2. Intermediate (6 cyl)
3. Full size (8 cyl)
4. 4 wheel drive
5. Recreational
6. Bus
7. Plane
8. Train
9. Motorcycle
10. Horseback
11. Walk

1. "First, about how many years have you been hunting?"
YEARS HUNTED ____

2. "What percentage of your hunting time was spent on foot or on horse back?"
TIME ____

3. "For hunting purposes, do you feel that the number of open roads in THIS AREA is: (Check One)
___ TOO FEW
___ ABOUT RIGHT
___ TOO MANY

4. "On average, how crowded did you feel this area was when you were hunting?" (Check One)
___ NOT AT ALL CROWDED
___ SOMEWHAT CROWDED
___ VERY CROWDED

5. "What do you perceive your chances of bagging a 4 point or better buck or 6 point or better bull elk are in this hunting area?"
Bull: ___ Poor ___ Fair ___ Good ___ Excellent
Buck: ___ Poor ___ Fair ___ Good ___ Excellent

6. "How many licensed hunters were in your vehicle?"
LICENSED HUNTERS ____

7. The next questions will help us to determine how much people spend on their Montana hunting trips. I'm going to list several things you may have spent money on specifically for this trip to ________. Could you tell me how much you spent, if anything, on each item during the trip?

NOTE - Read each item, then record a dollar value next to it

Total transportation costs (gas,oil,wear & tear) $ ____
% at home ____
% spent in route ____
% near or at site ____

Lodging, such as hotels or campground fees? $ ____
% spent in route ____
% near or at site ____

Food and beverages bought in stores? $ ____
% spent in route ____
% near or at site ____
% at home ____

Food and beverages bought in resturants? $ ____
% spent in route ____
% near or at site ____

Fees for guides or outfitters? $ ____

Any other on site purchases such as hunting equipment, film, auto repairs, etc. $ ____

8. "Was the trip to this area worth more than you paid?"
___ YES
___ NO

If yes, what is the maximum amount you would have been willing to spend to visit this hunting area rather than some other?
$ ____

9. "How does hunting compare to other types of outdoor recreation you do?" (Check One)
___ FAVORITE
___ ONE OF FAVORITE
___ ONE OF MANY

10. "Could you estimate the current market value of the equipment you have purchased over the years primarily for hunting such as guns, wall tents, campers, etc.?
CURRENT VALUE IN HUNTING EQUIP. $ ____

11. "How many children under 15 live in your household?"
CHILDREN ____

12. "How many years of education have you had?"
YEARS ____

NOTE: Elementary = 6 yrs
High School = 12 yrs
College Degree = 16 yrs
Master's Degree = 18 yrs
Ph D or MD = 20 yrs

13. "During this last fall, about how many hours a week did you normally work?" (Include time such as housework, volunteer work etc.) (Check One)
___ 01 - 10 HOURS
___ 11 - 20 HOURS
___ 21 - 30 HOURS
___ 31 - 40 HOURS
___ 41 - 50 HOURS
___ 51 - 60 HOURS
___ MORE THAN 60 HOURS.

14. "As I read the following age catagories, please indicate which one you are in." (Check One)
___ a. 12 - 15 ___ d. 30 - 39 ___ f. 50 - 61
___ b. 16 - 20 ___ e. 40 - 49 ___ g. 62 or older
___ c. 21 - 29

15. "I'm going to read a list of income categories. Could you please tell me which catagory your total household income before taxes in 1985 is in?"
___ a. 0 - 5,000 ___ f. 25,000 - 30,000
___ b. 5,000 - 10,000 ___ g. 30,000 - 40,000
___ c. 10,000 - 15,000 ___ h. 40,000 - 50,000
___ d. 15,000 - 20,000 ___ i. 50,000 - 75,000
___ e. 20,000 - 25,000 ___ j. MORE THAN 75,000
(please specify to nearest $10,000 dollar)

16. "This is the last question. Is there anything you would like to tell us about hunting in Montana?"